

## MAINTENANCE NOTE 20 (for Electronics Technicians)

Engineering Division

W/OSO321:FJZ

**ART-1/2 Tracking Alignment**General

1. Maintenance Note 20 provides a revised ART-1/2 tracking alignment procedure for use with the new Marconi 2024 Signal Generator. For purpose of consistency, this procedure follows the paragraph numbering scheme of the ART-1/2 instruction manual.



**Before proceeding with this alignment, ensure the Marconi 2024 memory configurations are set according to the Attachment found at the end of this note.**

2. Effect on Other Instructions: Make pen and ink changes to the Instruction Manual Number 9-601 (ART-1, 1R Maintenance) and 9-602 (ART-2, 2R Maintenance), Volume 1, page 5-33, paragraph 5.2.4.3. Enter the following notation: *"Refer to Maintenance Note 20 for ART-1/2 tracking alignment procedure."*

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## **Automatic Radiotheodolite (ART-1/2) Tracking Alignment**

### **5.2.4.3 Tracking Alignment**

This tracking alignment procedure is written for field level alignment and is applicable for periodic maintenance, performance verification, and particularly after the replacement of the following subassemblies:

#### **NOTE**

**Before proceeding, perform the Marconi signal generator memory configurations as described in the Attachment of this Receiver Alignment procedure.**

| <b>Sub Unit No.</b> | <b>Description</b>  |
|---------------------|---------------------|
| A2                  | AZ/EL Amplifier     |
| A3                  | EL Phase Comparator |
| A4                  | AZ Phase Comparator |
| A5                  | Video Amplifier     |
| A7                  | AFC/AGC Detector    |
| A14                 | Simulator Analog    |

#### **CAUTION**

**A receiver alignment must be performed before proceeding with the tracking alignment. Assemblies A5 and A7 contain adjustable components that are exclusively associated with the receiver circuit alignment and are addressed therein.**

**Parts of the tracking alignment must also be performed after any one of the following pedestal components are replaced.**

- (c) Any part of the pylon [requires reference generator phasing (starts in Section 5.2.4.2.2.12)].**
- (b) Azimuth or Elevation Tachometers (ART-2 only).**
- (c) Motor (ART-1) or clutches (ART-2) [requires idle current balancing adjustment (Section 5.2.4.3.2.5)]**

#### 5.2.4.3.1 Test Equipment Required

| Type                    | Manufacturer Model<br>(or equivalent) |
|-------------------------|---------------------------------------|
| Signal Generator        | Marconi 2024                          |
| Digital Voltmeter (DVM) | Fluke 8050A                           |
| Oscilloscope            | Tektronics 465                        |

#### 5.2.4.3.2 Tracking Alignment Procedure

To preserve continuity of setup and proper sequence of adjustments and measurements, perform (or verify) the following steps in the exact order given.

##### 5.2.4.3.2.1 Initial Setup

- a. Energize the System using normal start up procedures (refer to the Instruction Manual Automatic Radiotheodolite ART-1/ART-2 Maintenance Vol. 1, Section 3.3.1.6). Verify the following switches on the R/ACU.

| Switch              | Setting or Indication   |
|---------------------|-------------------------|
| AGC/MGC             | extinguished (AGC Mode) |
| LIMITED SEARCH MODE | illuminated             |
| MANUAL TRACK MODE   | illuminated             |
| LOW SENSITIVITY     | extinguished            |
| Test Selector       | EL ERROR                |
| STANDBY             | extinguished            |
| SIMULATOR POWER     | ON                      |

- b. Manually slew the antenna assembly in elevation and azimuth to a convenient position for unencumbered access and work space.

## CAUTION

**Do not remove or insert circuit card assemblies with power applied. To remove or insert circuit cards perform the following steps:**

- (1) Position the SYSTEM POWER switch to the OFF position.**
  - (2) Remove/insert the circuit card.**
  - (3) Position the SYSTEM POWER switch to the ON position.**
  - (4) Verify or reset front panel controls as necessary.**
- c. Unfasten and slide out the R/ACU. Access to internal connections on circuit card assemblies may be gained by use of the extender circuit card assembly A11.
  - d. Unless otherwise stated, work area is at the R/ACU (1A3A1). Any mention of reference designators are assumed to be preceded by "1A3A1."

### **5.2.4.3.2.2 Simulator Analog Balance Adjustment (A14R11 and A14R37)**

- a. Position R/ACU SYSTEM POWER switch to ON. Press to illuminate the MANUAL TRACK MODE pushbutton. Press to extinguish STANDBY pushbutton.
- b. Position SIMULATOR/OFF switch to OFF then to SIMULATOR.
- c. Verify that no 30 Hz sine waves are present at A14TP5 (EL) or A14TP8 (AZ). If so, no further balance adjustment is required; otherwise perform steps d through i.
- d. If 30 Hz sine waves are present at A14TP5 (EL) or A14TP8 (AZ), position R/ACU SYSTEM POWER switch to OFF. Place the Simulator Analog circuit card assembly (A14) on extender circuit card assembly A11.
- e. Position R/ACU SYSTEM POWER switch to ON. Press to illuminate MANUAL TRACK MODE pushbutton. Press to extinguish STANDBY pushbutton.
- f. Position SIMULATOR/OFF switch OFF, then to SIMULATOR.
- g. Connect the DVM & oscilloscope to A14TP5 (EL) and then adjust A14R11 to obtain a minimum signal level.
- h. Connect the DVM & oscilloscope to A14TP8 (AZ) and adjust A14R37 for a minimum 30 Hz signal.

- i. Position R/ACU SYSTEM POWER switch to OFF and place the Simulator Analog circuit card assembly A14 into its nested position.

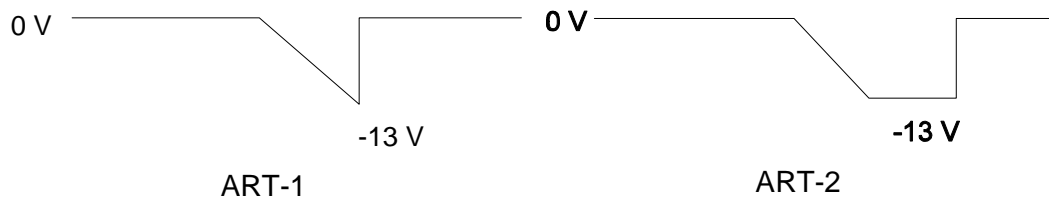
#### **5.2.4.3.2.3 Servo Drive Ramp Adjustment (A7R97)**

- a. Position R/ACU SYSTEM POWER switch to OFF. Raise the AFC/AGC Detector circuit card assembly A7 on the extender circuit card assembly A11.
- b. Position R/ACU SYSTEM POWER switch to ON. Press to illuminate STANDBY and MANUAL TRACK MODE pushbuttons.

#### **NOTE**

**Saturation or flattening of the positive peaks at the 0 Vdc level is normal.**

- c. Connect the oscilloscope to A7TP10. Set the oscilloscope controls for DC input and adjust the vertical gain and sweep speed to display 2 to 3 cycles of the 120 Hz sawtooth waveform.
- d. Adjust A7R97 for a saturated negative peak (approximately -13 V). The width of the negative saturated peak should be 2 1/4 ms. for the ART-2 and a saturated waveform for ART-1.



- e. Position SYSTEM POWER switch to OFF and place the AFC/AGC Detector circuit card assembly A7 into its nested position.

#### **5.2.4.3.2.4 Azimuth Static Alignment**

- a. Raise the Azimuth Phase Comparator circuit card assembly A4 on the extender circuit card assembly A11.
- b. Position SYSTEM POWER switch to ON and repeat the procedure in paragraph 5.2.4.3.2.1.

#### **5.2.4.3.2.4.1 Azimuth Tachometer Phase Null (A4R45) [ART-2 only]**

- a. Connect the oscilloscope to A4TP10.
- b. While slewing the antenna assembly in the azimuth axis, clockwise and then counterclockwise, adjust A4R45 until the best half-wave rectified waveform is obtained.

#### **5.2.4.3.2.4.2 Azimuth Tachometer Null (A4R37) [ART-2 only]**

- a. Slew the antenna assembly in elevation to at least 45 degrees.
- b. Press to illuminate STANDBY pushbutton. Verify that the motors stop running. At the R/ACU, position SYSTEM POWER switch to OFF.

### **WARNING**

**The Grey wire removed in the next step carries 115 VAC. To prevent bodily injury, ensure the SYSTEM POWER switch is in the OFF position before disconnecting the wire.**

- c. Remove the rear pedestal cover. At the azimuth drive assembly, carefully remove the grey wire from terminal 7. Cover the lead with tape to prevent it from shorting to ground.
- d. At the R/ACU, position SYSTEM POWER switch to ON. Press to extinguish the STANDBY pushbutton. Observe that only the elevation motor is running.
- e. Connect the oscilloscope between A4-AA (ART2-TAC on test panel) and ground. Adjust A4R37 for a minimum 60 Hz signal (0.15 V p-p typical).
- f. Connect the oscilloscope and DVM between A4TP10 and ground.
- g. Adjust the Azimuth Tachometer core for a null on the oscilloscope.
- h. Readjust A4R37 for the best null on the oscilloscope. Then readjust A4R37 to obtain 0 VDC on the DVM.
- i. Press to illuminate the STANDBY pushbutton. Verify the elevation motor stops running. At the R/ACU, position SYSTEM POWER switch to OFF.
- j. At the azimuth drive assembly, carefully secure the grey wire (removed in step c above) to terminal 7. Install the rear pedestal cover.
- k. At R/ACU position SYSTEM POWER switch ON. Press to extinguish the STANDBY pushbutton. Verify that both drive motors are running.

#### **5.2.4.3.2.5 Azimuth Drive current Idle Balance (A2R59 and A2R62)**

- a. Verify the MANUAL TRACK MODE pushbutton is illuminated and that STANDBY pushbutton is extinguished.
- b. Position the test selector switch to AZ DRIVE. Alternately position the auxiliary test switch between UP/CW and DN/CCW while observing the SERVICE METER display. Normal system readings are  $8.0 \pm 0.5$  FA for both switch positions; if not, accomplish steps c (1) and (2). (ART-1 is 4 FA and ART-2 is set for 8 FA.)
- c. If the SERVICE METER reading is not as specified in step b, above, adjust balance resistor 1A3A1A1A2R62 and threshold resistor 1A3A1A1A2R59 as follows:

#### **NOTE**

**Gain access to resistors by pulling the R/ACU drawer out until slide locks engage.**

- (1) Locate the Azimuth/ Elevation Amplifier circuit card assembly 1A3A1A1A2.
- (2) Adjust the balance resistor R62 to equalize the SERVICE METER readings for both auxiliary switch positions.
- (3) Adjust the threshold resistor R59 to obtain a reading on the SERVICE METER for both auxiliary switch positions.
- (4) Repeat the adjustment sequence until a normal reading is obtained on the SERVICE METER for both auxiliary switch positions.

#### **NOTE**

**If after the alignment the pedestal creeps, adjust balance resistor R62 to eliminate creep. Verify, by using the test #8 on the simulator and observe the digital display.**

#### **5.2.4.3.2.6 Azimuth Tachometer Gain Adjustment (A4R80 and A4R81)**

- a. Press to illuminate STANDBY, NEAR AUTO TRACK MODE and AGC/MGC pushbuttons.
- b. Locate and position switches A4S1-1 and A4S1-2 OFF (open).

#### **NOTE**

**The MGC voltage is used as a variable input to the tachometer amplifier.**

- c. Connect a short clip lead jumper between A7-D (Gain on test panel) and the junction of A4R79 and A4R83.
- d. Set the DVM to DC scale and connect the positive lead to A7-D and the negative lead to ground. Adjust MGC-GAIN control to achieve a DVM reading of  $+1.0 \pm 0.05$  Vdc. Remove the DVM.
- e. Verify the NEAR AUTO TRACK MODE pushbutton is illuminated. Connect the DVM between A4TP8 and ground. Adjust A4R80 to achieve a DVM reading of  $-1.1 \pm 0.01$  VDC for the ART-2 and  $-0.6$  VDC for the ART-1.
- f. Press to illuminate the FAR AUTO TRACK MODE pushbutton.
- g. Verify that A7-D is still at  $+1.0 \pm 0.05$  Vdc level. If not, readjust MGC-GAIN control to achieve a DVM reading of  $1.0 \pm 0.05$  Vdc. Remove DVM.
- h. Connect the DVM between A4TP8 and ground. Adjust A4R81 to achieve a DVM reading of  $-4.7 \pm 0.1$  VDC. for the ART-2 and  $-8.5$  VDC for the ART- 1.
- i. Verify that A7-D is still at  $+1.0 \pm 0.05$  VDC. if not, repeat steps g and h.
- j. Disconnect the clip lead jumper from A7-D.
- k. Reposition switch A4SI-I to the ON (closed) position.
- l. Verify that switch A4S1 is set as follows:

| Contacts (A4S1)  | 1    | 2   | 3      | 4  |
|------------------|------|-----|--------|----|
|                  | TACH |     | FILTER |    |
| Position (ART-2) | ON   | OFF | OFF    | ON |
| Position (ART-1) | OFF  | ON  | OFF    | ON |

- m. Position SYSTEM POWER switch to OFF and place the Azimuth Phase Comparator circuit card assembly A4 into Its nested position.

#### **5.2.4.3.2.7 Elevation Static Alignment**

- a. Raise the Elevation Phase Comparator circuit card assembly A3 on the extender circuit card A11.
- b. Position SYSTEM POWER switch to ON and repeat the procedure outlined in paragraph 5.2.4.3.2.1.

#### **5.2.4.3.2.7.1 Elevation Tachometer Phase Null (A3R45) [ART-2 only]**

- a. Connect the oscilloscope to A3TP10.
- b. While slewing in the elevation axis (up then down), adjust A3R45 until the best half-wave rectified waveforms are obtained.

#### **5.2.4.3.2.7.2 Elevation Tachometer Null (A3R37) [ART-2 only]**

- a. Slew the antenna assembly in elevation to about 60 degrees. Remove the elevation housing top and side covers.
- b. Press to illuminate the STANDBY pushbutton. Verify the motors stop running. At the R/ACU, position SYSTEM POWER switch to OFF.

### **WARNING**

**The white wire removed in the next step carries 115 Vac. To prevent bodily injury, ensure the SYSTEM POWER switch is in the OFF position before disconnecting the wire.**

- c. At the elevation drive assembly carefully remove white wire from terminal 7. Cover the lead with tape to prevent it from shorting to ground.
- d. At the R/ACU, position SYSTEM POWER switch to ON. Press to extinguish the STANDBY pushbutton. Observe that only the azimuth motor is running.
- e. Connect the oscilloscope between A3-AA (ART2-TAC on test panel) and ground. Adjust A3R37 for a minimum 60 Hz signal (0.15 V p-p typical).
- f. Connect the oscilloscope and DVM between A3TP10 and ground.
- g. Adjust elevation tachometer core for a null on the oscilloscope (0.1 V p-p typical).
- h. Readjust A3R37 for the best null on the oscilloscope. Then readjust A3R37 for 0 VDC on the DVM.
- i. Press to illuminate the STANDBY pushbutton. Verify the azimuth motor stops running. At the R/ACU, position SYSTEM POWER switch to OFF.
- j. At the elevation drive assembly, remove the tape from the end of the white wire and carefully secure the wire to terminal 7. Install the elevation housing covers.
- k. At R/ACU, position SYSTEM POWER switch to ON. Press to extinguish STANDBY pushbutton. Verify that both drive motors are running.

#### **5.2.4.3.2.8 Elevation Drive Current Idle Balance (A2R23 and A2R26)**

- a. Verify the MANUAL TRACK MODE pushbutton is illuminated and the STANDBY pushbutton is extinguished.
- a. Position the test selector switch to EL DRIVE. Alternately, position the auxiliary test switch between UP/CW and DN/CCW while observing the SERVICE METER display. Normal system readings are  $8.0 \pm 0.5$  FA for both switch positions; if not, accomplish steps c (1) and (2). (ART- 1 is 4 FA and ART-2 is set for 8 FA).
- c. If the SERVICE METER reading is not as specified in step b, above, adjust balance resistor 1A3A1A1A2R26 and threshold resistor 1A3A1A1A2R23 as follows:

#### **NOTE**

**Gain access to resistors by pulling the R/ACU drawer out until slide locks engage.**

- (1) Locate the Azimuth/Elevation Amplifier circuit card assembly 1A3A1A1A2.
- (2) Adjust balance resistor R26 to equalize the SERVICE METER readings for both auxiliary switch positions.
- (3) Adjust threshold resistor R23 to obtain reading on SERVICE METER for both auxiliary switch positions.
- (4) Repeat the adjustment sequence until a normal reading is obtained on the SERVICE METER for both auxiliary switch positions.

#### **NOTE**

**If after the alignment the pedestal creeps, adjust balance resistor R26 to eliminate creep. Verify, by using the test #8 on the simulator and observe the digital display.**

#### **5.2.4.3.2.9 Elevation Tachometer Gain Adjustment (A3R80 and A3R81)**

- a. Press to illuminate STANDBY, NEAR AUTO TRACK MODE and AGC/MGC pushbuttons.
- b. Locate and position switches A3S1-1 and A3S1-2 OFF (open).

#### **NOTE**

**MGC voltage is used as a variable input to the tachometer amplifier.**

- c. Connect a short clip lead jumper between A7-D (on test panel) and the junction of A3R79 and A3R83.
- d. Set the DVM to DC scale and connect it between the clip lead Jumper to A7 pin D and ground. Adjust the MGC GAIN control to achieve a DVM reading of  $+1.0 \pm 0.05$  VDC. Remove the DVM.
- e. Verify that the NEAR AUTO TRACK MODE pushbutton is illuminated. Connect the DVM between A3TP8 and ground. Adjust A3R80 to achieve a DVM reading of  $-1.1 \pm 0.01$  VDC for the ART-2 and  $-0.6$  VDC for the ART-1.
- f. Press to illuminate the FAR AUTO TRACK MODE pushbutton.
- g. Verify that A7 pin D is still at  $+1.0 \pm 0.05$  Vdc level. If not, readjust MGC GAIN control to achieve a DVM reading of  $+1.0 \pm 0.05$  Vdc. Remove DVM.
- h. Connect the DVM between A3TP8 and ground. Adjust A3R81 to achieve a DVM reading of  $-4.7 \pm 0.1$  VDC for the ART-2 and  $-8.5$  for the ART-1.
- i. Verify that A7 pin D is still at  $+1.0 \pm 0.05$  VDC. If not, repeat steps g and h.
- j. Disconnect the clip lead jumper from A7 pin D.
- k. Reposition switch A3S1-1 to the ON (closed) position.
- l. Verify that switch A3S1 is set as follows:

| Contacts (A4S1)  | 1    | 2   | 3      | 4  |
|------------------|------|-----|--------|----|
|                  | TACH |     | FILTER |    |
| Position (ART-2) | ON   | OFF | OFF    | ON |
| Position (ART-1) | OFF  | ON  | OFF    | ON |

- m. Position SYSTEM POWER switch to OFF and place the Elevation Phase Comparator circuit card assembly A3 into its nested position.

#### **5.2.4.3.2.10 Active Alignments Using the Simulator**

##### **5.2.4.3.2.10.1 Video Amplifier Alignment (A14R36 and A5R10)**

- a. Repeat the procedure in paragraph 5.2.4.3.2.1.
- b. Connect the RF output of the Signal Generator to SIMULATOR IN (J1) at the RF Assembly.
- c. Connect the AM input jack on the Signal Generator to the SIMULATOR OUT connector on the Pedestal Assembly.

- d. Press [RCL] 112 [ENTER] and [CARR ON/OFF] to set the signal generator to 1680 MHz, -30 dBm.
- e. Execute Test # 2 on the simulator as follows:
  - (1) Press 2 on the simulator keypad (a 2 will appear in the upper display).
  - (2) Press the ENT key (the 2 will appear in lower display).
  - (3) Press the EXC key (RUN will appear in upper display).
- f. Set the DVM for AC scale and connect DVM and oscilloscope between A5TP2 and ground.
- g. Press to illuminate the STANDBY and OVERRIDE pushbuttons.
- h. By hand, slowly slew the antenna assembly in azimuth, clockwise or counterclockwise, to achieve a DVM reading of  $450 \pm 50$  mv AC. If a DVM reading of  $450 \pm 50$  mv AC is unobtainable, adjust A14R36 counterclockwise. This adjustment will increase the Azimuth Simulator output gain.
- i. Reconnect the DVM to A5TP3 and adjust A5R10 for a DVM reading of  $350 \pm 10$  mv AC. This sets the gain stage for the nominal gain of 0.78. (MAINTAIN 350 mv AC on A5TP3 and perform the Video Amplifier Phase Adjust in the next section).

#### **5.2.4.3.2.10.2 Video Amplifier Phase Adjustment (A5R16)**

- a. Position test selector switch to EL ERROR.
- b. Adjust A5R16 for 0 FA, observed on SERVICE METER.

#### **5.2.4.3.2.10.3 Azimuth Servo Amplifier Adjustment (A2R42)**

- a. On the SIMULATOR keyboard, press CLR three times to clear the display and then execute Test # 2. Refer to paragraph 5.2.4.3.2.10.1, e.
- b. Connect the DVM between A4TP2 and ground.
- c. Press to extinguish STANDBY pushbutton. Verify the MANUAL TRACK MODE pushbutton is illuminated. Slew the antenna assembly counter-clockwise to achieve a reading of +1.0 VDC on the DVM. (CW will give a negative voltage reading.).
- d. Press to illuminate the pushbuttons in the following sequence: STANDBY, OVERRIDE and NEAR AUTO TRACK MODE.

- e. Connect the DVM between A2TP6 and ground. Adjust A2R42 to obtain a reading of -1.9 VDC for the ART-2, -1.2 VDC for the ART-1.

#### **5.2.4.3.2.10.4 Azimuth Simulator Gain Adjustment (A14R36)**

- a. Press to illuminate the MANUAL TRACK MODE pushbutton. Press to extinguish the STANDBY and OVERRIDE pushbuttons.
- b. Slew the antenna assembly clockwise about 10 degrees from its present position. Press to illuminate the pushbuttons in the following sequence: STANDBY, OVERRIDE and NEAR AUTO TRACK MODE.
- c. With the DVM still connected between A2TP6 and ground, adjust A14R36 to obtain a reading of  $\pm 12$  VDC, or any positive or negative maximum number.

#### **5.2.4.3.2.10.5 Elevation Servo Amplifier Adjustment (A2R3)**

- a. On the simulator keypad, press the CLR button three times and then execute Test # 2 refer to paragraph 5.2.4.3.2.10.1, e.
- b. Connect the DVM between A3TP2 and ground.
- c. Press to illuminate the MANUAL TRACK MODE pushbutton. Press to extinguish the STANDBY and OVERRIDE pushbuttons. Slew the antenna assembly DOWN to achieve a reading of +1.0 VDC on the DVM. (UP will give a negative reading.).
- d. Press to illuminate the pushbuttons in the following sequence: STANDBY, OVERRIDE and NEAR AUTO TRACK MODE .
- e. Connect the DVM between A2TP2 and ground. Adjust A2R3 to obtain a reading of -1.9 VDC on the ART-2, -1.2 VDC for the ART-1.

**j j j MAINTAIN TEST 2 FOR THE NEXT ADJUSTMENT j j j**

#### **5.2.4.3.2.10.6 Elevation Simulator Gain Adjustment (A14R6)**

- a. Press to illuminate the MANUAL TRACK MODE pushbutton. Press to extinguish the STANDBY and OVERRIDE pushbuttons.
- b. Slew the antenna assembly approximately 10 degrees up from its present position. Press to illuminate the pushbuttons in the following sequence: STANDBY, OVERRIDE and NEAR AUTO TRACK MODE pushbuttons.
- c. With the DVM still connected between A2TP2 and ground, adjust A14R6 to obtain a reading of +12 VDC.

- d. Disconnect the Signal Generator from the RF Assembly.

#### **5.2.4.3.2.11 Servo Amplifier overload Adjustment (A2)**

##### **5.2.4.3.2.11.1 Overload Threshold (A2R82)**

- a. Position R/ACU SYSTEM POWER switch to OFF.
- b. Remove the CAUTION cover from the Azimuth Servo Amplifier Module (1A3A1A4) located on the left side of the R/ACU chassis - right unit.
- c. Remove the wire from terminal 6 of the Azimuth Servo Amplifier Module.
- d. Raise the Azimuth/Elevation circuit card assembly A2 on the extender circuit card assembly A11.
- e. Position R/ACU SYSTEM POWER switch to ON.
- f. Repeat the procedure in paragraph 5.2.4.3.2.1.
- g. Connect the DVM or oscilloscope input to the junction of A2R83 and A2R84. Adjust A2R82 (overload threshold) for an indicated voltage of  $3.0 \pm 0.3$  Vdc.

##### **5.2.4.3.2.11.2 Overload Timing (A2R95)**

- a. Connect a short clip lead jumper to the wire that was removed from terminal 6 in paragraph 5.2.4.3.2.11.1, c.
- b. At this time, false alarms of OBSTRUCTION or OVERLOAD are possible. If necessary, press to extinguish OBSTRUCTION pushbutton.
- c. While observing the OVERLOAD indicator, connect the free end of the clip lead jumper to test point PS4TP2 (+5 V) and note the delay time for illumination of the OVERLOAD indicator.
- d. Remove the clip lead from PS4TP2. Momentarily touch the clip lead to ground. Reset OVERLOAD by pressing the OBSTRUCTION pushbutton (reset switch).
- e. Adjust A2R95 as necessary, while repeating steps b and c to obtain an overload delay time of  $10 \pm 3$  seconds as measured from time of +5 V contact to illumination of OVERLOAD indicator.
- f. Position R/ACU SYSTEM POWER switch to OFF. Remove clip lead from R/ACU. Connect wire to terminal 6 and install CAUTION cover on the Azimuth Servo Amplifier 1A3A1A4.
- g. Place Azimuth/Elevation Amplifier circuit card assembly A2 into its nested position.
- h. Position R/ACU SYSTEM POWER switch to ON

#### **5.2.4.3.2.11.3 Safety Bar Test. (ART-2 only)**

- a. With the STANDBY pushbutton extinguished and elevation and azimuth motors running, slew antenna assembly up or down to a position where the safety bar can be reached.
- b. Apply pressure to the safety bar, in the direction of the pedestal; the elevation and azimuth motors should stop running, and the OBSTRUCTION indicator should illuminate.
- c. Reset OVERLOAD by pressing the OBSTRUCTION pushbutton (reset switch); elevation and azimuth motors should start to run.

#### **5.2.4.3.2.12 Reference Generator Alignment**

- a. Activate the on-site target antenna.
- b. Repeat the initial setup procedure in paragraph 5.2.4.3.2.1.
- c. Point the antenna assembly at the target antenna. Observe that the receiver locks on to 1680 MHz.
- d. Manually slew the antenna assembly to maximize the received signal strength; use the SIGNAL LEVEL/FREQ meter to observe the signal strength.

#### **5.2.4.3.2.12.1 Coarse Adjustment**

- a. Press to illuminate MANUAL TRACK MODE pushbutton.
- b. Slew the antenna to the approximate test target antenna angles.
- c. Connect channel 1 of oscilloscope to A5TP1. Use AC coupling. Trigger on channel 1 input. Adjust the oscilloscope controls to display two cycles of the AM signal.
- d. Slowly slew the antenna in azimuth for minimum peak-to-peak signal as viewed on the oscilloscope.
- e. Slowly slew the antenna in elevation for minimum peak-to-peak signal as viewed on the oscilloscope.
- f. Start simulator test 8 and note both the elevation and azimuth angles.
- g. Slew the antenna 1 degree UP.
- h. Slew the antenna 1 degree CW.

- i. Observe the values for the elevation and azimuth errors on the service meter. Both error voltages should be negative and approximately equal in value ( $\pm 10$  uA). This ensures that the reference generator is not 180 degrees out of phase. If the error voltages are incorrect, adjust the reference generator.
- j. Complete the phasing adjustment procedures in paragraph 5..2.4.3.2.12.2

#### **5.2.4.3.2.12.2 Reference Generator Final Setting**

- a. Press to illuminate FAR AUTO TRACK MODE pushbutton and lock system onto test target antenna.
- b. Connect channel 1 of oscilloscope to A5TP1. Use AC coupling. Trigger on channel I input. Adjust the oscilloscope controls to display two cycles of the AM signal.
- c. Press to illuminate MANUAL TRACK MODE pushbutton.
- d. Slowly slew the antenna in azimuth for minimum peak-to-peak signal as viewed on the oscilloscope.
- e. Slowly slew the antenna in elevation for minimum peak-to-peak signal as viewed on the oscilloscope.
- f. Start simulator test 8 and note both the elevation and azimuth angles.
- g. Connect channel 2 of the oscilloscope to A5TP2. Use AC coupling. Trigger on channel 1 input. Adjust the oscilloscope controls to display both channels.
- h. Move antenna 1 degree UP.
- i. Observe the oscilloscope and adjust A5R16 so the signal at A5TP2 is in phase with A5TP1. This centers the adjustment of A5R16.
- j. Set the service meter to AZ ERROR.
- k. Set the DVM for DC and connect it across the terminals of the service meter. Using the DVM increases the accuracy of the phasing adjustment. It also enables the technician to adjust the reference generator while viewing the DVM.
- l. Adjust the reference generator for 0 on the DVM.
- m. Press to illuminate FAR AUTO TRACK MODE and let the system lock onto the test target antenna. Compare the angles displayed on the simulator to the angles noted in step f. They should be within 0.03 degrees. The dead zone in the far auto tracking mode is affected by the adjustment of A3R81 (elevation) and A4R81 (azimuth) . Excessive dead zone in the near auto tracking mode indicates a defect in the system.

- n. Press to illuminate MANUAL TRACK MODE pushbutton.
- o. Slew the antenna 2 degrees UP.
- p. Adjust A5R16 for 0 on the DVM. This is the fine adjustment of the system phasing.
- q. Press to illuminate FAR AUTO TRACK MODE pushbutton and let the system lock onto the test target antenna.
- r. Press to illuminate MANUAL TRACK MODE pushbutton.
- s. Move antenna 1 degree CW.
- t. Set the service meter to EL ERROR. Verify that the EL ERROR is less than 1.0 uA (1 division on the service meter).
- u. Press to illuminate FAR AUTO TRACK MODE pushbutton, and let the system lock onto the test target antenna.
- v. Press to illuminate MANUAL TRACK MODE pushbutton.
- w. Move the antenna 1 degree CCW.
- x. Verify that the EL ERROR is less than 1.0 uA (1 division on the service meter.) If the system cannot be phased to less than 1 division, the pylon may be defective.

#### **NOTE**

**Incorrect system phasing will cause excessive interaction between channels and prevent acceptable RMS comparative values from being obtained.**

- y. Remove both oscilloscope leads from A5.
- z. Remove the DVM.

#### **5.2.4.3.2.12.3 Final Check**

- a. Point the antenna assembly at the target antenna and lock on the receiver in frequency and angle.
- b. Slew the antenna assembly approximately 3 to 4 degrees clockwise and press the NEAR AUTO TRACK MODE pushbutton. Observe the antenna assembly reset response. It should be rapid with a small overshoot.
- c. Repeat step b for counterclockwise, up and down directions.

- d. Slew the antenna assembly approximately 3 to 4 degrees clockwise and press the FAR AUTO TRACK MODE pushbutton. Observe the antenna assembly reset response. It should be smooth and slow, taking about 15 to 20 seconds to stabilize.
- e. Repeat step d for counterclockwise, up and down directions.
- f. At the MCU, repeat steps b through e, noting each final stabilized angle displayed on the Angle/Time Display. Calculate the reset deadband errors the difference between the up and down, and the clockwise and counterclockwise displays. Reset deadband error must be less than 0.03 degree.



















If the error in the NEAR AUTO TRACK MODE is small but the error in the FAR AUTO TRACK MODE is excessive, reduce the FAR AUTO tachometer feedback by turning counterclockwise A3R81 for elevation and A4R81 for Azimuth to achieve proper deadband response in FAR AUTO TRACK MODE. Excessive deadband in NEAR AUTO TRACK MODE or instability (oscillation) in either mode indicates improper alignment or a system fault.

This concludes the Tracking Alignment procedure.

## ATTACHMENT

### Marconi 2024 Memory Settings

Perform the following signal generator parameter memory stores. The ART alignment refers to these memory settings to facilitate the signal generator setup for the receiver and tracking alignments. Reading the table from left to right, follow the instructions given below. Reference the Marconi Operating Manual for complete operating instructions.

| Saving Power Up Settings                         |                                                                                     |      |                                                                                     |                                                                                                                                                                                      |        |                                                                                       |
|--------------------------------------------------|-------------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------|
| To reset generator to factory settings           |    | 999  |    |                                                                                                   |        |                                                                                       |
| 2                                                |                                                                                     |      | ENTER                                                                               |                                                                                                                                                                                      |        |                                                                                       |
| Set to 1680 MHz                                  |    | 1680 |    |                                                                                                                                                                                      |        |                                                                                       |
| 2                                                |                                                                                     |      |                                                                                     |                                                                                                                                                                                      |        |                                                                                       |
| Enable internal pulse modulation                 |  | 22   |   | 2                                                                                                                                                                                    |        |                                                                                       |
| 2                                                |                                                                                     |      | ENTER                                                                               |                                                                                                                                                                                      |        |                                                                                       |
| Set to -60 dBm                                   |  | -60  |  |                                                                                                                                                                                      |        |                                                                                       |
| 2                                                |                                                                                     |      | ENTER                                                                               |                                                                                                                                                                                      |        |                                                                                       |
| Set to AM external                               |  | 20   |  | <br>or<br> | AM ext |  |
| 2                                                |                                                                                     |      | ENTER                                                                               |                                                                                                                                                                                      |        |                                                                                       |
| Set modulation source and AM depth of modulation |  | 30   |  | <br>or<br> | Ext:   | 2                                                                                     |
| 2                                                |                                                                                     |      | ENTER                                                                               |                                                                                                                                                                                      |        |                                                                                       |



ON

30



Store settings

2



100



Storing power up settings

2



54



or



Power Up Choice

1



Recall memory

100



### Storing AGC Alignment Settings

Store 1655 MHz

2



1655



101



Store 1670 MHz

2



1670



102



0



Store 1690 MHz

2



1690



1



---

Recall 1680 MHz

2

RCL

100

Hz  
rad dB  
ENTER

---

Store -74 dBm

2

RF  
LEVEL

-74

Hz  
rad dB  
ENTER

STO

103

Hz  
rad dB  
ENTER

---

Store -5 dBm

2

RF  
LEVEL

-5

Hz  
rad dB  
ENTER

STO

104

Hz  
rad dB  
ENTER

---

Store -100 dBm

2

RF  
LEVEL

-100

Hz  
rad dB  
ENTER

STO

105

Hz  
rad dB  
ENTER

---

Store -80 dBm

2

RF  
LEVEL

-80

Hz  
rad dB  
ENTER

STO

106

Hz  
rad dB  
ENTER

---

Store -104 dBm

2

RF  
LEVEL

-104

Hz  
rad dB  
ENTER

STO

107

Hz  
rad dB  
ENTER

---

Store -4 dBm

2

RF  
LEVEL

-4

Hz  
rad dB  
ENTER

STO

108

Hz  
rad dB  
ENTER

---

Storing AFC Alignment Settings

Store 10.7 MHz at  
6.2 dBm for a 1.6 -  
1.8 V p-p output level

2

CARR  
FREQ

10.7

MHz  
ms mV

RF  
LEVEL

6.2

Hz  
rad dB  
ENTER



STO

109

Hz  
rad dB  
ENTER

Store 10.45 MHz

2

CARR  
FREQ

10.45

MHz  
ms mV

STO

110

Hz  
rad dB  
ENTER



STO

2

Hz  
rad dB  
ENTER

Store 10.95 MHz

2

CARR  
FREQ

10.95

MHz  
ms mV

STO

3

Hz  
rad dB  
ENTER

Storing MET Data Digitizer Settings

Store 1680 MHz at  
-60 dBm, INT Pulse  
Mod ON at 100 Hz

2

RCL

100

Hz  
rad dB  
ENTER

MOD

MOD

Pulse  
Mod INT  
OFF



SOURCE  
ON/OFF

Pulse Mod  
INT ON

MOD  
SOURCE

100

Hz  
rad dB  
ENTER

STO



111

Hz  
rad dB  
ENTER

---

### Video Amplifier Alignment (A14R36 and A5R10)

---

Store -30dBm

2

RCL

103

Hz  
rad dB  
ENTER

RF  
LEVEL

-30

Hz  
rad dB  
ENTER



STO

112

Hz  
rad dB  
ENTER